

**3.2 Medical Requirements Overview****TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW**

<b>MRID# and Title:</b>	MR001S Operational Tilt Test
<b>Sponsor:</b>	Medical Operations
<b>IPT:</b>	Cardiovascular
<b>Category:</b>	Medical Requirements (MR)
<b>References:</b>	Astronaut Medical Evaluation Requirements Document (AMERD) JSC 24834, Appendix B, Section IV (4.1 a, 4.2 a, 4.2 b, 4.2 c)
<b>Purpose/Objectives:</b>	Stand tests are used to assess the effects of prolonged weightlessness on orthostatic tolerance during upright posture. Attempts are made to identify high-risk crewmembers before their current flight and adjust their in-flight countermeasures accordingly, such as varying the proportion of aerobic versus resistive exercise and adjusting end-of-mission countermeasures. Postflight data are used to guide rehabilitative measures and optimize performance on future flights. Group data are used to assess the influence of other physical and physiological factors such as countermeasures, mission duration, heat stress, etc.
<b>Measurement Parameters:</b>	Supine and standing blood pressure, heart rate, stroke volume, cardiac output, and total peripheral resistance (TPR).
<b>Deliverables:</b>	A cardiovascular status assessment which will provide a basis for in-flight countermeasure treatments, an evaluation of the prescribed countermeasures, and a determination of a crewmember's postflight recovery status.
<b>Flight Duration:</b>	< 30 days
<b>Number of Flights:</b>	All
<b>Number and Type of Crew Members Required:</b>	All rookie astronauts and/or first-time Shuttle flyers; all crewmembers who had orthostatic intolerance after their previous mission
<b>Other Flight Characteristics:</b>	Pre- and postflight data collection only

**3.3 Preflight Training – No Preflight Training****3.4 Preflight Activities****TABLE 3.4: PREFLIGHT ACTIVITIES**

Preflight Activity	Description:	Crewmember will be instrumented and placed on tilt table (~5 min.) - Supine (~6 min.) - Upright (80° tilt) (~10 min.) - Questionnaire (~2 min.) Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		Operation Tilt Test: 30 minutes	L-10 days	N/A	Lab personnel/Crewmember
Ground Support Requirements Hardware/Software	Preflight Hardware:		Preflight Software:	Test Location:	
	Tilt Table Finger beat-to-beat blood pressure monitor Teac recorder ECG monitor Ultrasound unit Blood pressure monitor Strip chart recorder		N/A N/A N/A N/A N/A N/A	U.S. U.S. U.S. U.S. U.S. U.S.	
Testing Facilities	Minimum Room Dimensions:		Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	12' x 12'		2 (120V) isolated and protected outlets that have their own independent power source	72 °F	None
	Hot or Cold Running Water:		Privacy Requirements:	Vibration/Acoustic Isolation:	Other:
	None		Limit to 3 operators and necessary flight surgeon	None	None
Constraints/Special Requirements:		See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior to testing, no heavy meals 4 hr prior to testing and no food at all 2 hr prior to testing.			

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<b>Launch Delay Requirements:</b>	Data collection will be repeated if launch is delayed by more than 3 months.
<b>Notes:</b>	N/A
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b> A preliminary test report will be delivered by Discipline lead or designated lab personnel to the Flight Surgeon no later than the L-3 date. The preliminary test report and final, completed data analysis report will be submitted to the Flight Surgeon and Data Activist no later than 3 weeks after the completed session.

**Test Termination Criteria:** If any of the following instances occur while the crewmember is standing, the crewmember will be laid down and monitoring continued until the subject is stable.

1. A sudden drop in heart rate greater than 15 beats per minute.
2. A sudden drop in blood pressure (systolic fall >25 mm Hg or diastolic fall > 15 mm Hg).
3. Significant cardiac arrhythmias:
  - a. Bradyarrhythmias (example: heart rate < 40 for people whose resting heart rate is > 50)
  - b. Tachyarrhythmias (3 or more beats in a row of supraventricular or ventricular tachycardia)
  - c. Evidence of heart block other than first degree
  - d. PVC's which meet any of the following criteria:
    - Six or more PVC's per minute
    - PVC's that are closely coupled
    - PVC's that fall on the T wave of the preceding beat
    - PVC's that occur in couplets or runs
    - PVC's that are multi-formed
4. An absolute systolic blood pressure < 70 mm Hg
5. Severe nausea, clammy skin, profuse sweating, pallor, light-headedness, dizziness, or tingling
6. Crewmember request at any time.

**3.5 In-Flight Activities – No In-Flight Activities****3.6 Postflight Activities****TABLE 3.6: POSTFLIGHT ACTIVITIES**

Postflight Activity	Description:	Crewmember will be instrumented and placed on tilt table (~5 min.) - Supine (~6 min.) - upright (80° tilt) (~10 min.) - Questionnaire (~2 min.) Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		Operation Tilt Test 30 minutes	R+0 R+3* R+10*	N/A	Lab personnel/Crewmember
Ground Support Requirements Hardware/Software	Postflight Hardware:		Postflight Software:	Test Location:	
	Tilt Table Finger beat-to-beat blood pressure monitor Teac recorder ECG monitor Ultrasound unit Blood pressure monitor Strip chart recorder		N/A N/A N/A N/A N/A N/A	U.S. U.S. U.S. U.S. U.S. U.S.	
Testing Facilities	Minimum Room Dimensions:		Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	12' x 12'		2 (120V) isolated and protected outlets that have their own independent power source	72 °F	None
	Hot or Cold Running Water:		Privacy Requirements:	Vibration/Acoustic Isolation:	Other:
	None		Limit to 3 operators and necessary flight surgeon	None	None
Constraints/Special Requirements:		See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior to testing, no heavy meals 4 hr prior to testing and no food at all 2 hr prior to testing.			

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<b>Early Destow / Early Return:</b>	Data collection will be repeated if launch is delayed by more than 3 months.
<b>Notes:</b>	*R+3, R+10 if clinically indicated.
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b> A preliminary test report of the crewmembers R+0 data will be delivered by the Discipline lead or designated lab personnel to the Flight Surgeon on landing day. The preliminary test report will also be required on test day for any additional contingency sessions prescribed by the crewmember's Flight Surgeon. In addition, a package containing the preliminary test report and final, completed data analysis report will be submitted to the Flight Surgeon and Data Archivist no later than 3 weeks after the final MAT date.

## 3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	BLOOD VOLUME	PERSONNEL REQUIRED	CONSTRAINTS
<b>Preflight Training – N/A</b>						
<b>Preflight</b>						
Operational Tilt Test	30 Minutes	L-10 days	N/A	N/A	Lab personnel/ Crewmember	See Note.
<b>In-Flight – N/A</b>						
<b>Wheels-Stop – N/A</b>						
<b>Postflight</b>						
Operational Tilt Test	30 Minutes	R+0 R+3 R+7 days	N/A	N/A	Lab personnel/ Crewmember	See Note. R+0 should be performed within 3 hours of landing. R+3 for flights ≤20 days, as indicated. R+7 for flights 21 – 30 days, if different from preflight on R+3.
<b>Postflight Debrief – N/A</b>						

Note: Recommend no medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior to testing, no heavy meals 4 hr prior to testing and no food at all 2 hr prior to testing.